

Muon Background Estimation from 1/3 and 2/3 samples

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Motivation

- Muon background level in the PRL paper
⇒ obtained from full sample to reduce statistical error.
- All other backgrounds were estimated with 2/3 samples.
- What is the muon background level obtained from 1/3 or 2/3 sample?
⇒ For my Ph.D thesis, all the backgrounds should be derived in the same (consistent) ways.

Background Estimation from 1/3 and 2/3 samples

	Tail Background		
	Full	1/3 sample	2/3 sample
1×1	4.636 ± 0.206	3.971 ± 0.271	4.960 ± 0.250
PV'	5.100 ± 0.225	4.414 ± 0.296	5.441 ± 0.274
TD'	4.580 ± 0.204	3.900 ± 0.266	4.915 ± 0.248
KIN'	4.636 ± 0.206	3.971 ± 0.271	4.960 ± 0.250
BOX	0.0103 ± 0.0012	0.0094 ± 0.0015	0.0110 ± 0.0013
BOX'	0.0441 ± 0.0056	0.0401 ± 0.0070	0.0473 ± 0.0062

	Band Background		
	Full	1/3 sample	2/3 sample
1×1	2.187 ± 0.138	0.654 ± 0.109	2.964 ± 0.194
PV'	3.849 ± 0.243	1.142 ± 0.191	5.225 ± 0.342
TD'	2.178 ± 0.137	0.649 ± 0.109	2.951 ± 0.193
KIN'	2.269 ± 0.144	0.649 ± 0.109	2.951 ± 0.193
BOX	0.0049 ± 0.0006	0.0016 ± 0.0003	0.0066 ± 0.0008
BOX'	0.0244 ± 0.0030	0.0076 ± 0.0017	0.0328 ± 0.0041

How the background level in the candidate cell change?

	Tail	Band
Full sample	0.303 ± 0.044	0.052 ± 0.014
1/3 sample	0.428 ± 0.099	0.016 ± 0.011
2/3 sample	0.232 ± 0.049	0.070 ± 0.019

- Relatively large tail background in 1/3 sample is just due to the statistics in normalization branch.
- Should we use the background level obtained from 2/3 sample for the candidate cell? or can we still use that from full sample?

Outside-the-BOX Study?

- Perform the Outside-the-BOX study with 2/3 sample.
- Predictions from full and 2/3 samples.

	$K_{\mu 2}$: TD×kin.(tail)				
	10×10	20×20	50×50	80×50	120×50
predict (full):	0.35 ± 0.03	1.44 ± 0.1	9.07 ± 0.62	14.52 ± 0.99	21.78 ± 1.48
predict (2/3):	0.37 ± 0.03	1.51 ± 0.12	9.54 ± 0.75	15.27 ± 1.20	22.91 ± 1.80
observe:	0 ± 0	1 ± 1	12 ± 3.5	16 ± 4	25 ± 5

	$K_{\mu 2}$: TD×kin.(band)				
	10×10	20×20	50×50	80×50	120×50
predict (full):	0.32 ± 0.03	1.28 ± 0.11	3.22 ± 0.27	5.17 ± 0.44	10.35 ± 1.07
predict (2/3):	0.42 ± 0.04	1.73 ± 0.15	4.37 ± 0.37	7.00 ± 0.60	14.03 ± 1.47
observe:	1 ± 1	1 ± 1	4 ± 2	5 ± 2.2	11 ± 3.3

Summary

- Muon background level from 1/3 and 2/3 samples were estimated.
- Larger background level was obtained from 2/3 sample than that from full sample due to statistical fluctuation of the number of remained events in the normarization branch.
- Smaller background level in the candidate cell was obtained from 2/3 sample.
- It should be decided which sample (2/3 or full) is used for my Ph.D thesis.
 - 2/3 sample for the estimation of total muon background level?
 - full or 2/3 sample for the estimation of background level in the candidate cell?